

Supplemental Materials

Smartphone Habits are Stronger in Spaces Chosen out of Habit

Results

Spatial and Smartphone Habit Interaction

Main Associations

In the models predicting app use in a spatial context based on each combination of spatial and smartphone habit indicators, each spatial or smartphone habit indicator was included in two of the eight models. Thus, there were main associations between each spatial or smartphone habit indicator and app use in context in two models. These associations did not vary based on the other habit indicator in the model. For example, results for route frequency held in the model with app frequency as well as the model with app automaticity. Although route habit indicators were generally not positively associated with app use in a spatial context, route automaticity was positively related to conditional app use on routes. See the Analysis Scripts (Analysis 4.5.1.1. and 4.5.1.2.) for full reporting.

Spatial Familiarity

We additionally examined the role of spatial familiarity given its potential to drive the effects of spatial habits on smartphone habits. *Route familiarity* was obtained from the map-based trip questionnaires described in the Method of the main manuscript. *Destination familiarity* was derived for a random subsample of participants ($n = 132$) from experience sampling data collected as part of the broader project ($n = 9,029$ surveys). Analyses involving destination familiarity excluded five participants who did not complete the measure in at least two destinations. See the Method below for operationalization of these self-report indicators.

We first specified separate multilevel linear mixed-effects models predicting spatial familiarity based on spatial habit indicators, nesting spatial contexts within participants. When people travelled a route habitually (i.e., frequently or automatically), the route was more likely to

be familiar. When people visited a destination habitually (i.e., frequently or automatically), the destination was not more likely to be familiar. See the Analysis Scripts (Analysis 4.3.) for full reporting.

We then tested the interaction of spatial familiarity and smartphone habits, mirroring the interaction models described in the main manuscript by substituting spatial familiarity for spatial habit strength. We specified four multilevel negative binomial hurdle models predicting app use in a spatial context based on each combination of spatial familiarity and smartphone habit indicators as well as their interaction terms. Overall, app habit strength was not a stronger predictor of app use on more (vs. less) familiar routes or in more (vs. less) familiar destinations. See the Analysis Scripts (Analysis 4.4.1.1. and 4.4.2.1.) for full reporting.

Comparing Social and Non-Social Apps

Context-Independence:

Main Associations. Smartphone habit indicators were positively associated with context-independence in 15 of the 20 models, with the exceptions that, for routes, automaticity did not predict context-variety or any of the four operationalizations of context-consistency, and for destinations, automaticity did not predict one operationalization of context-consistency (overall time-based). See the Analysis Scripts (Prep 3.7.3. to 3.7.6.) for full reporting.

Automaticity Models. We report the results of the associations between app type and each indicator of context-independence for routes and destinations from the automaticity models (see the main manuscript for the results from the frequency models). Compared to non-social apps, social apps were used on more routes but not in more destinations, and social apps were more likely to be used consistently across destinations under one of the four operationalizations

of context-consistency (overall app-based) but under none of the four operationalizations for routes. See the Analysis Scripts (Prep 3.7.3. to 3.7.6.) for full reporting.

Spatial and Smartphone Habit Interaction

Main Associations. In the models predicting app use in a spatial context based on each combination of spatial and smartphone habit indicators for each app type (social and non-social), some spatial and smartphone habit indicators were not positively associated with app use in spatial context. For social apps, route frequency was not associated with non-use or conditional use, route automaticity was not associated with non-use, destination automaticity was not associated with non-use, and app automaticity was not associated with conditional use on routes. For non-social apps, route frequency was not associated with conditional use (when controlling for app frequency) or non-use and route automaticity was not associated with non-use. See the Analysis Scripts (Analysis 4.5.1.3. to 4.5.1.6.) for full reporting.

Social Apps. For more frequent social apps, non-use was less likely on more frequent routes (Model 9a, $OR = 0.75$, $CI = [0.69, 0.82]$, $p < .001$) and on more automatic routes (Model 10a, $OR = 0.82$, $CI = [0.72, 0.93]$, $p = .002$), but not in more frequent destinations (Model 11a, $OR = 0.98$, $CI = [0.95, 1.01]$, $p = .14$) or in more automatic destinations (Model 12a, $OR = 0.90$, $CI = [0.69, 1.18]$, $p = .44$). Among the apps that were used, more frequent social apps were used more frequently on more frequent routes (Model 9b, $RR = 1.03$, $CI = [1.01, 1.06]$, $p = .02$), in more frequent destinations (Model 11b, $RR = 1.02$, $CI = [1.01, 1.02]$, $p < .001$) and in more automatic destinations (Model 12b, $RR = 1.23$, $CI = [1.12, 1.36]$, $p < .001$), but not on more automatic routes (Model 10b, $RR = 1.05$, $CI = [0.97, 1.13]$, $p = .23$).

For more automatic social apps, non-use was less likely on more frequent routes (Model 13a, $OR = 0.88$, $CI = [0.82, 0.94]$, $p < .001$) and in more automatic destinations (Model 16a, $OR =$

0.72, $CI = [0.54, 0.98]$, $p = .04$), but not on more automatic routes (Model 14a, $OR = 0.90$, $CI = [0.77, 1.06]$, $p = .20$) or in more frequent destinations (Model 15a, $OR = 0.99$, $CI = [0.96, 1.01]$, $p = .32$). Among the apps that were used, more automatic social apps were used more frequently in more frequent destinations (Model 15b, $RR = 1.02$, $CI = [1.01, 1.02]$, $p < .001$), but not on more frequent routes (Model 13b, $RR = 1.01$, $CI = [0.97, 1.05]$, $p = .63$), or in more automatic destinations (Model 16b, $RR = 0.95$, $CI = [0.83, 1.10]$, $p = .52$), and they were used *less* frequently on more automatic routes (Model 14b, $RR = 0.88$, $CI = [0.77, 1.00]$, $p = .04$).

Non-Social Apps. For more frequent non-social apps, non-use was less likely on more frequent routes (Model 17a, $OR = 0.80$, $CI = [0.70, 0.93]$, $p = .003$), on more automatic routes (Model 18a, $OR = 0.79$, $CI = [0.62, 1.00]$, $p = .047$), in more frequent destinations (Model 19a, $OR = 0.82$, $CI = [0.76, 0.88]$, $p < .001$), and in more automatic destinations (Model 20a, $OR = 0.48$, $CI = [0.25, 0.93]$, $p = .03$). Among the apps that were used, more frequent non-social apps were used more frequently on more frequent routes (Model 17b, $RR = 1.12$, $CI = [1.02, 1.24]$, $p = .02$), in more frequent destinations (Model 19b, $RR = 1.05$, $CI = [1.03, 1.06]$, $p < .001$), and in more automatic destinations (Model 20b, $RR = 1.71$, $CI = [1.30, 2.25]$, $p < .001$), but not on more automatic routes (Model 18b, $RR = 1.18$, $CI = [0.96, 1.45]$, $p = .11$).

For more automatic non-social apps, non-use was not less likely on more frequent routes (Model 21a, $OR = 0.94$, $CI = [0.86, 1.03]$, $p = .19$), on more automatic routes (Model 22a, $OR = 0.88$, $CI = [0.71, 1.10]$, $p = .26$), in more frequent destinations (Model 23a, $OR = 0.98$, $CI = [0.96, 1.00]$, $p = .10$), or in more automatic destinations (Model 24a, $OR = 0.93$, $CI = [0.67, 1.28]$, $p = .65$). Among the apps that were used, more automatic non-social apps were used more frequently in more frequent destinations (Model 23b, $RR = 1.02$, $CI = [1.01, 1.03]$, $p = .001$), and in more automatic destinations (Model 24b, $RR = 1.46$, $CI = [1.15, 1.86]$, $p = .002$), but not on

more frequent routes (Model 21b, $RR = 1.00$, $CI = [0.93, 1.07]$, $p = .997$), or on more automatic routes (Model 22b, $RR = 1.01$, $CI = [0.80, 1.28]$, $p = .91$). See the Analysis Scripts (Analysis 4.4.3. to 4.4.6.) for full reporting.

Method

Spatial Familiarity

For routes, familiarity was obtained from the map-based trip questionnaires. Each participant indicated how new or familiar the route felt, from “Very new” (1) to “Very familiar” (4). *Route familiarity* was the mean familiarity out of the total trips taken along a route.

For destinations, familiarity was obtained for a random subsample of participants from experience sampling data collected as part of the broader project. Based on broader project goals, a subsample was randomly assigned to complete the measure of familiarity during experience sampling surveys. Each participant indicated how unfamiliar or familiar their current location felt, from “Very unfamiliar” (1) to “Very familiar” (5). Surveys were matched to destinations if they were completed during a visit to a destination. Participants completed this measure in 55.9% of their 1,126 destinations ($n = 629$). *Destination familiarity* was the mean familiarity out of the total surveys completed in a destination.

Robustness Checks

We specified three robustness checks of the models of the interaction between spatial and smartphone habits (overall and for social and non-social apps): (1) excluding frequented spatial contexts, (2) excluding participants with few spatial contexts, and (3) using an additional indicator of smartphone habits.

Frequented Spatial Contexts

We considered the robustness of the interaction findings when excluding highly frequented spatial contexts (e.g., routes between home and work, the home as a destination). App use in these spatial contexts comprises a large proportion of overall app frequency, presenting concern for models that predict such app use based on overall app frequency. We therefore reran analyses without each participant's most frequent spatial context, excluding participants who only had a single spatial context after excluding this context. Results were generally robust to these robustness checks.

Few Spatial Contexts

We considered the robustness of the interaction findings to individuals with fewer spatial contexts. App use in top spatial contexts comprises larger proportions of overall app frequency for people with fewer spatial contexts, presenting concern for models that predict such app use based on overall app frequency. We therefore reran analyses with the half of the participants with more spatial contexts. Results were generally robust to these robustness checks.

Subjective App Frequency

We considered the robustness of the interaction findings to an additional indicator of smartphone habits. We measured a subjective indicator of app frequency. Participants rated subjective app frequency in the endpoint survey after they estimated their top eight most frequently used apps. They reported how often they used these apps¹, using a nine-point scale from “Never” (0) to “2-3 times an hour” (8). We specified additional models of the interaction between spatial and smartphone habits using subjective app frequency as the smartphone habit indicator. For comparability, these models leverage the apps with automaticity self-reports. Results of these models aligned more with results for subjective app automaticity than results for

objective app frequency, but were generally robust to this indicator of smartphone habit. See Analysis Scripts (Analysis 4.4.1. to 4.4.6.) for full reporting.

Navigation Apps

We reran all analyses in the main manuscript while excluding Maps & Travel (i.e., navigation) apps. Almost all results were robust to their exclusion, with one exception: Route habit indicators generally did not predict app use in context when including navigation apps, but these indicators generally *did* predict app use in context when excluding them. Specifically, route frequency became positively related to conditional app use on routes (controlling for app frequency) and route automaticity became negatively related to non-use on routes (controlling for app frequency or app automaticity). In other words, these results were stronger when excluding navigation apps.

References

1. Boase, J., & Ling, R. (2013). Measuring mobile phone use: Self-report versus log data. *Journal of Computer-Mediated Communication*, **18**, 508-519.
<https://doi.org/10.1111/jcc4.12021>